

Learner Version

Advanced Warning Operations Course IC Core 4 Data Quality Lesson 5

VCP Explorer Job Sheet 1 VCP Explorer V2.x

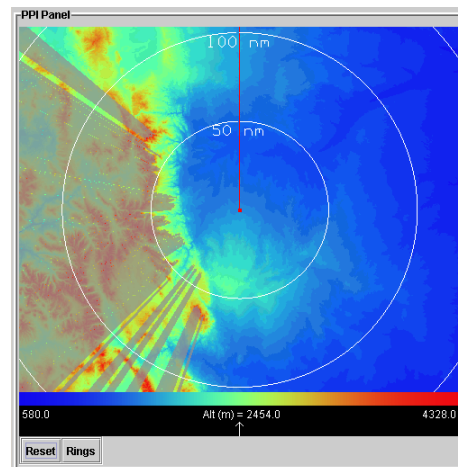
Objective: The objective of this exercise is to learn the basic operations of VCP Explorer and to use VCP Explorer to examine radar ground clutter patterns.

In this exercise, "LM" refers to the left-mouse button, "MM" refers to the middle mouse button, and "RM" refers to the right-mouse button.

1. Start VCP Explorer and change the active radar to Denver (KFTG).
[File → Choose Radar → KFTG]

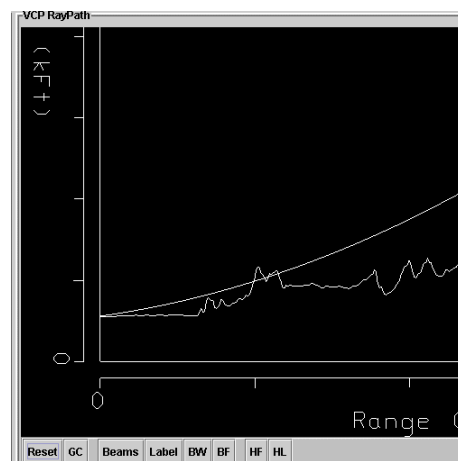
2. Turn on the Ground Clutter (beam blockage) view.
[GC button]

3. Zoom on the PPI display so that the 100 nmi range ring fills the display as shown in the figure to the right.
[Shift+RM+Drag]



4. Turn on the beam-width display.
[BW or BF button]
5. Examine the character of the ground clutter pattern by looking at various azimuths between 270° and 312° and between 198° and 230°. Note the relative amounts of beam filling by the terrain that occur with different azimuths.
[type various azimuth numbers in the Azimuth box and press Enter]

6. Change the azimuth to 235°. If *super-refractive* conditions were to occur (as opposed to the "normal" conditions assumed by the 4/3 earth's radius model), at what range might beam blockage at 0.5° begin to appear? What is the "normal" beam height at that azimuth and range?
[type 235 in the Azimuth box and press Enter. Zoom]



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(Shift+RM+Drag) and/or pan (RM+Drag) the RHI plot to obtain a view similar to the figure to the right. Use the cursor readout function (MM+Drag or LM+RM+Drag) to get the value].

- Change the VCP to VCP 12. Change the azimuth to 260°. At what range does the beam blockage start on the lowest tilt?

Under “normal” propagation conditions, speculate about any beam blockage on the second tilt (0.9°). At what range might you expect it to begin?

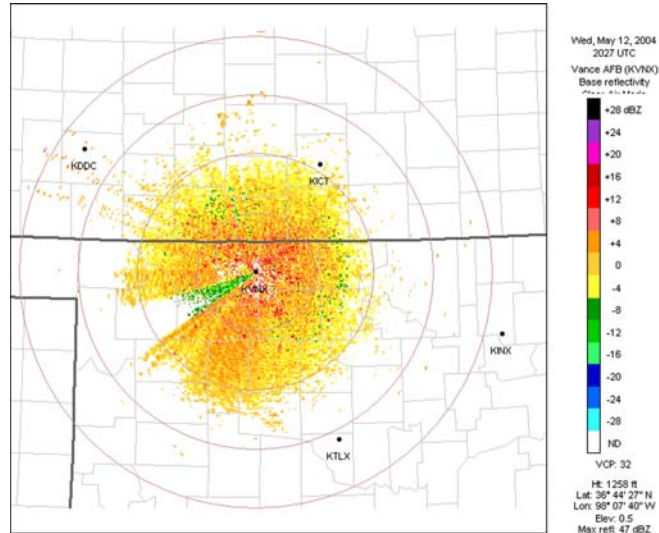
Change to the second tilt to check your answer.

[click the  button]

Turn on the ground clutter shading for 0.9° and describe the pattern.

[GC button]

- The image to the right is a base reflectivity image from late afternoon from the Vance Air Force Base (KVNK) WSR-88D at 0.5° on a well-mixed day. Note the beam blockage southwest of the radar between the 238° and 253° azimuths. Use VCP Explorer to speculate on the cause of the beam blockage. Hint: try to make VCP Explorer mimic the observed beam blockage pattern by changing the elevation angle and the beam blockage percentage values.



- Use VCP Explorer to investigate any beam blockage or ground clutter patterns from your own radar(s) by using the functions shown in Steps 1-7 above. If your local radars do not exhibit beam blockage, you may choose one of the radars below:

Western Region		
ATX – Seattle	BBX – Beale AFB	EMX – Tucson
EYX – Edwards AFB	IWA – Phoenix	MTX – Salt Lake City
PDT – Pendleton	TFX – Great Falls	VTX – Los Angeles
Central Region		
GJX – Grand Junction	PUX – Pueblo	UDX – Rapid City

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Southern Region		
ABX – Albuquerque	EPZ – El Paso	MRX – Morristown
SRX – Fort Smith		
Eastern Region		
CXX – Burlington	ENX – Albany	FCX – Roanoke
GSP – Greer	GYX – Portland, ME	LWX – Sterling
Hawaii/Pacific Regions		
PACG – Biorka Island	PAEC – Nome	PAKC – Anchorage
PHKI – South Kauai	PKMO – Molokai	PHWA – South Shore

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VCP Explorer Job Sheet 2 VCP Explorer V2.x

Objective: The objective of this exercise is to use VCP Explorer to visualize the sampling of the lower atmosphere by the precipitation-mode VCPs.

In this exercise, "LM" refers to the left-mouse button, "MM" refers to the middle mouse button, and "RM" refers to the right-mouse button.

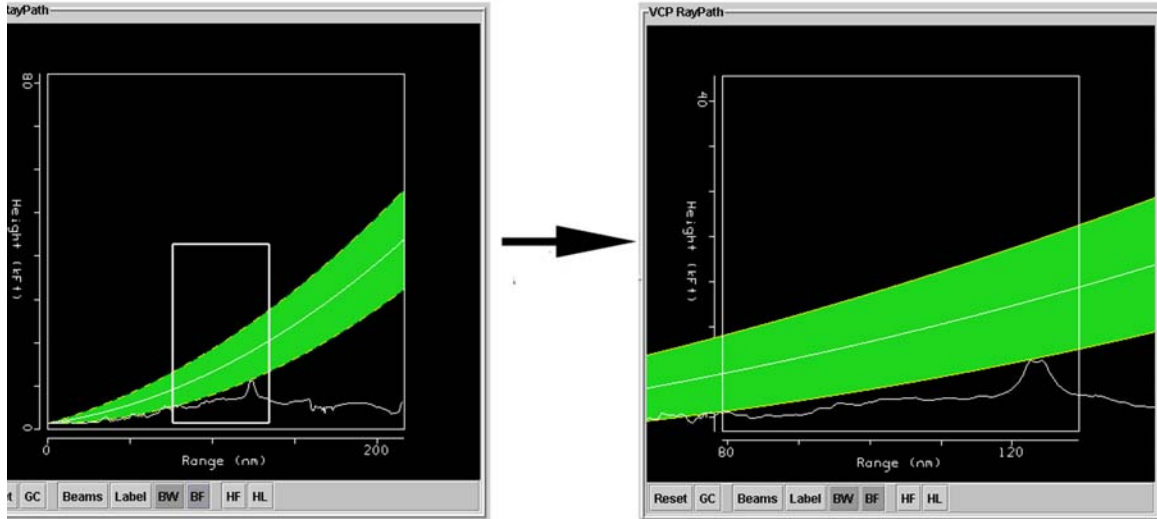
1. Start VCP Explorer and use the default radar [KIWA]. Make sure the VCP is set to VCP 21. Turn on the beam width, beam labels, and beam filling functions. Note how the beams for the individual tilts are adjacent to one another.
[Click the Beams, Label, BW, and BF buttons]
2. Change the VCP to VCP 11. Although there are more tilts, the beams are still adjacent to one another. Turn off the Beams function and successively cycle through adjacent elevation angles to see the relationship between adjacent tilts.
[Click the Beams button. Click on 0.5, 1.45, 2.40, 3.35, 4.30, etc. in sequence]
3. Change the VCP to VCP 12, and successively cycle through the tilts below 8.0°. What is noticeably different between VCP 11 and VCP 12?

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4. Change the VCP back to VCP 11. Choose the 0.5° elevation scan and turn on the beam filling option.

[Click the BF button]

Zoom the RHI display so that the vertical scale is between 5 and 40 kft and the horizontal (range) scale is between 80 and 120 nmi as shown in the figure below.



[Use Shift+LM+Drag to draw a zoom box for the desired area]

Use the cursor-readout feature to see the lower and upper extent of the beam at 100 nmi.

[MM+Drag or LM+RM+Drag]

Fill out the following table for a range of 100 nmi:

Tilt	Elevation	Lower Beam Height	Upper Beam Height
VCP 11 Tilt 1			
VCP 11 Tilt 2			
VCP 12 Tilt 1			
VCP 12 Tilt 2			
VCP 12 Tilt 3			

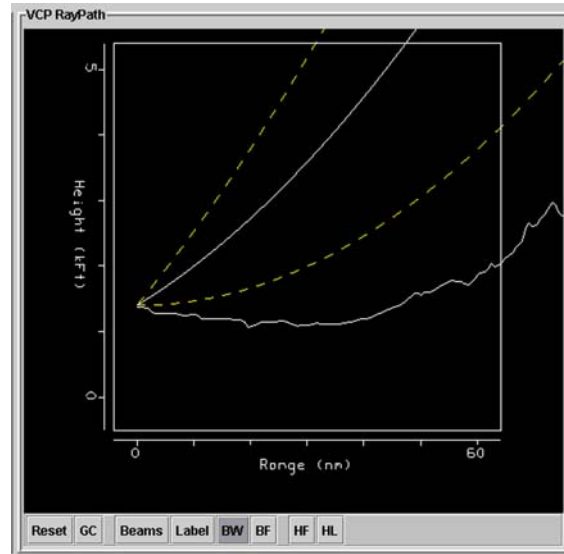
5. Using the table from Question 4, what tilts would sample a mass of reflectivity at 100 nmi that extended 5,000 feet upward from a base of 12,500 feet?

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6. What impact would the choice of VCP 11 versus VCP 12 have on algorithms such as VIL that accumulate reflectivity in a vertical column?

7. A low-level cold pool extends vertically from the surface upwards to 2,000 feet above the surface. Assume this cold pool can be observed by KIWA at an azimuth of 300° . Beyond what range will the 0.5° beam not sample *any portion* of the cold pool? (Hint: zoom the RHI plot so that the vertical scale goes from 0 to 4000 ft and the horizontal scale ranges between 0 and 60 nm as shown).

[To zoom, Shift+RM+Drag; To draw a zoom box, Shift+LM+Drag]



8. For the KIWA radar, the 0.5° tilt does not have 50% beam blockage at the 357° azimuth (i.e., the GC button does not shade the 357° azimuth). Assess the implications of the terrain on the radar's ability to sample winds in the lowest 4000 ft of the atmosphere (MSL) at the 357° azimuth.

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VCP Explorer Job Sheet 3 VCP Explorer V2.x

Objective: The objective of this exercise is to use VCP Explorer to understand the sampling of a steady state thunderstorm at different ranges by a given VCP.

In this exercise, "LM" refers to the left-mouse button, "MM" refers to the middle mouse button, and "RM" refers to the right-mouse button.

1. Start VCP Explorer, and change to the KMQT radar. Set the VCP to VCP 11. Assume you have a thunderstorm that is 40,000 feet tall. Click on the HL button and move the horizontal green line down to 40,000 feet.
[click on the green box at the right endpoint of the line and drag it to 40 kft]

This section is mostly applicable to the operation of the WSR-88D's suite of algorithms, which assume that an echo must reach a particular beam's center point to be observed by that beam. The yellow line given by the HL option shows the difference between the radar's perception (the closest beam center point that is below the echo) and reality (the echo itself).

2. Click on the Beams button (it may already be selected) and the Label button. What tilt samples the 40,000 foot level at a range of 135 nm?

What is the height of that tilt's center point at 135 nm?

What is the difference between reality and the radar's perception?

3. The thunderstorm has moved 15 nautical miles farther away from the radar. Now, what is the difference between reality and the radar's perception of the 40,000 foot level?
4. The thunderstorm has moved 5 more miles farther from the radar. By how much distance does the radar underestimate the 40,000 foot level at this range?
5. Click the HF button and toggle off the HL button. The colors represent the difference in height between an actual echo (at a given range and height) and the nearest beam center-point that is below that range/height location. For

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example, at a range of 150 nmi and a height of 37 kFT, has a yellow/orange color value. Sliding the pointer under the Ht Underestimate color bar to the yellow/orange range reveals the height underestimate is ~4 km. This means that the radar thinks the actual 37,000 ft echo is at the 0.5 beam centerpoint which is at 24,000 ft. ($37,000 \text{ ft} - 24,000 \text{ ft} = 13,000 \text{ ft} = \sim 3.96 \text{ km}$).

6. Assume a steady-state thunderstorm moves away from the radar. What is the height underestimate for the 30,000 foot level at the following distances from the radar?

Range	Height Underestimate	Range	Height Underestimate
30 nmi		60 nmi	
75 nmi		85 nmi	
95 nmi		120nmi	
125 nmi		135nmi	
150 nmi		170 nmi	

What implications does this table have on algorithm performance for a storm that moves away from the radar?

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VCP Explorer Job Sheet 4 VCP Explorer V2.x

Objective: The objective of this exercise is to use VCP Explorer to understand the effect of the VCP on the sampling of a steady state thunderstorm at a given range from the radar.

In this exercise, "LM" refers to the left-mouse button, "MM" refers to the middle mouse button, and "RM" refers to the right-mouse button.

1. Start VCP Explorer, and change to the KGLD radar. Set the VCP to VCP 21. Assume you have a hail core located at 25,000 ft MSL that is 75 nmi away from the radar. Click on the HL button and move the horizontal green line down to 25,000 feet. The line will serve as a reference guide through this exercise. Click on the HF button.
[click on the green box at the right endpoint of the line and drag it to 25,000 feet]
2. In VCP 21, what tilt observes the hail core?
What is the height of the beam centerpoint?
What is the height underestimate of the hail core?
[move the arrow under the color bar to the appropriate color, cyan]
3. In VCP 11, what tilt observes the hail core?
4. In VCP 12, what tilt observes the hail core?
[Hint: To refresh the HL line, you may need to move it away from the 25,000 level and then move it back]

What is the height of the beam centerpoint?

What is the height underestimate of the hail core?

Based upon this consideration alone, which VCP would improve the detection of the hail core by the HDA?

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5. Repeat this exercise with a hail core that is 20 nmi but at 35,000 ft.

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VCP Explorer Job Sheet 5 VCP Explorer V2.x

Objective: The objective of this exercise is to use VCP Explorer to visualize the effect of temperature and humidity profiles on radar beam propagation

In this exercise, "LM" refers to the left-mouse button, "MM" refers to the middle mouse button, and "RM" refers to the right-mouse button.

1. In order to do this exercise, you will need access to a sounding in BUFR or AWIPS NetCDF format. In particular, you will also need the 18Z BUFR file from the Eta model for Phoenix on August 14, 2003 at which is located at http://wdtb.noaa.gov/courses/AWOC/ICCore4/lesson5/eta_phx.03081418.buf. Place this file in an easy-to-find location on your computer.

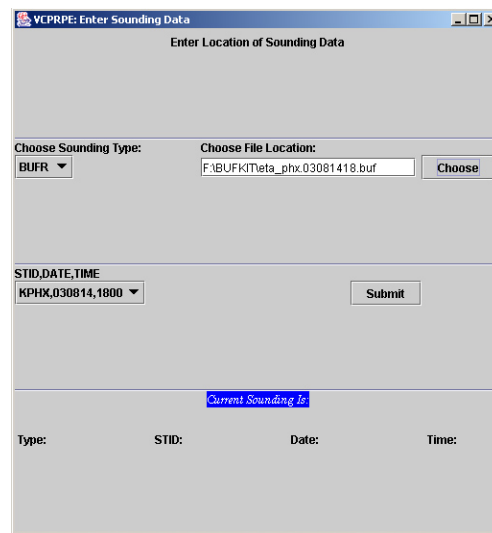
2. Start VCP Explorer, and change to the KIWA radar. Set the VCP to VCP 21.

3. Load the Phoenix BUFR file into VCP Explorer.

[Compare → Sounding. When the sounding window comes up, make sure the Sounding Type is BUFR. Click the Choose button and navigate on your computer to choose the eta_phx.03081418.buf file.]

4. Choose the KPHX sounding for 08/14/2003 at 1800 UTC.

[Click the Submit button. Do not close the Sounding data window.]

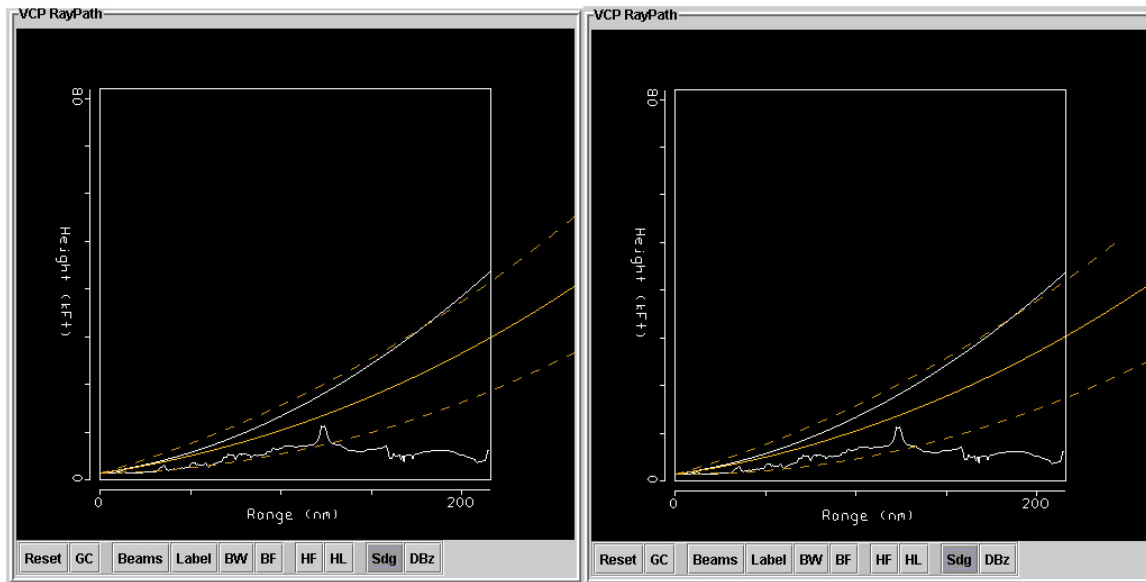


5. In the main VCP Explorer window, click on the Sdg button. Notice that the actual beam path differs significantly from the beam path assumed by the standard atmosphere.

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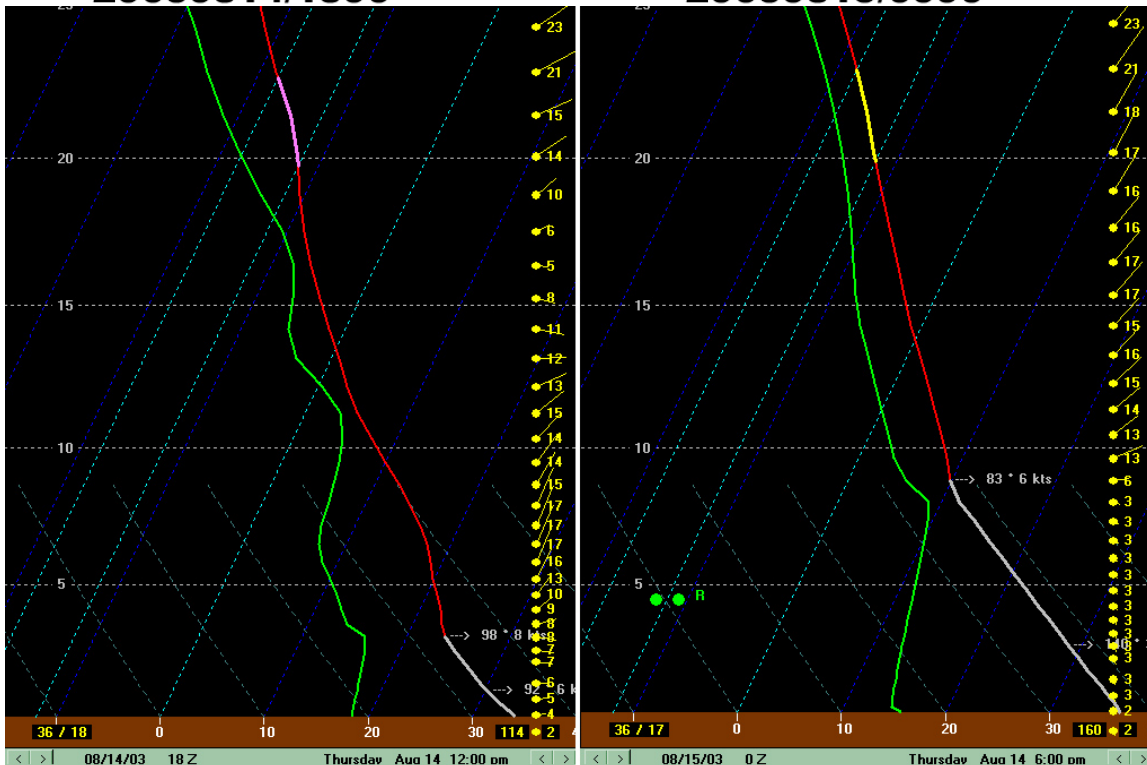
6. Change the sounding time to 08/15/2003 at 0000 UTC. What happened to the radar beam?

[In the Sounding window, change the sounding to KPHX,030815,0000 and click the submit button.]



20030814/1800

20030815/0000



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7. Step through the elevation angles to see the effect of the sounding profile on higher radar tilts.
8. Since the actual beam path differs from the beam height assumed from the standard atmosphere, speculate on the ramifications of this difference on downstream WSR-88D products. In particular, what impact would a lower-than-theoretical radar beam have on the hail detection algorithm if the actual beam were above the 0°C and/or -20°C threshold levels?
9. Repeat this exercise using your own sounding data with your local radar.

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